Final Report
Puget Sound Estuary Program 2011-2017
Cooperative Agreement for Puget Sound Restoration
EPA Grant PC-00J20101
Toxics and Nutrients

October 31, 2017

This final report provides an overview of the implementation activities, accomplishments, funding, and lessons learned from this six-year Cooperative Agreement.

Background

The goal of this federal National Estuary Program (NEP) Puget Sound Toxics and Nutrients grant was to improve human and environmental health in the Puget Sound ecosystem by preventing, reducing, and controlling toxics and nutrients from entering the Sound. This grant was unique compared to the other NEP grants because it addressed two key pollutants of concern versus rather just addressing a single issues, such as pathogens.

The Department of Ecology (Ecology) responded in November 2010 with a proposal to EPA's RFP, EPA-R10-PS-1007, "Puget Sound Action Agenda: Ecosystem Restoration and Protection Funding". This proposal was for Ecology to serve as the Lead Organization (LO) for Toxics and Nutrients (T/N). National Estuary Program (NEP) funding was to be provided in annual increments estimated to total $48 million over six years. Ecology was asked to match this proposed amount for a total project amount of $96 million. EPA subsequently selected Ecology for this tasking challenge. On January 19, 2011 EPA Region 10 provided an initial award of $3,089,252 to begin the T/N program as Round #1 Rounds correspond to annual awards). The overall project period was designated as February 1, 2011 through June 30, 2017.

Amendment # 1 was approved on July 21, 2011 and provided additional funding of $5,470,000 to the project as Round #2. On January 18, 2012, EPA awarded Ecology an additional $160,000 to perform an additional work plan add. Ecology received a third increment of NEP funding from EPA on July 16, 2012 in the amount of 3,545,000 (Round #3). A final Round #4 add of $3,320,582 was awarded by EPA on August 8, 2013. On September 26, 2014 EPA provided a special dedicated award of $81,909 to support ocean acidification modeling work. The above amendments provided a total budget within the T/N grant of $15,666,743.

The match requirement for the T/N program was established as 50%. Ecology's designated match was a portion of a large grant to Pierce County Public Works to expand the capacity of the Chambers Creek Regional Wastewater Treatment Plant (discharging to Puget Sound). The final Match expenditure was $16,650,852.

Ecology internally closed the T/N Cooperative Agreement PC-00J20101 on June 30, 2017. Final invoices and expenditures were accounted for resulting in the full expenditure of all federal funds in the amount of $15,666,743. When the match is included, the total project expended $32,317,950 on Puget Sound restoration and protection activities.

This federal grant provided flexible funding to allow Ecology to fund and pursue activities and sub-projects (NTAs) focused on enhancing Puget Sound. In addition, the results of this total body of work serves as a key foundational element for the continuation of the new EPA Strategic Initiative Funding Model and Ecology's efforts to improve Action Agenda Vital Signs through the Stormwater Strategic Initiative (SW SI).

Infrastructure

After accepting the initial Round #1 award Ecology began forming a project team in February 2011. A lead was designated to manage the six-year T/N Cooperative Agreement PC-00J20101. A personnel process was established to hire a Grants Specialist to handle the sub-recipient agreements position needed to implement that portion of the overall NEP model. In addition, Ecology designated a specialist as a centralized asset to assist all three Lead Organizations with the production and management of quality assurance project plans (QAPP) for projects containing monitoring components.

Core group

The T/N Lead solicited and formed a core group (Core) of people, with experience in nutrients and toxics, to help develop a 6-year strategy for this grant agreement. The goal of the strategy was "*to improve human and environmental health in the Puget Sound Ecosystem by preventing, reducing, and controlling toxics and nutrients from entering the Sound"*. This strategy used the foundations of the Puget Sound Action agenda near term actions (NTA) and recommendations of the science panel to lay out the strategy. The people that made up the Core team consisted of staff from the Department of Ecology, the Puget Sound Partnership, and the Environmental Protection Agency. In addition to the Core group a sub-group was used to help get additional input on how to focus the nutrient part of this strategy. The Natural Resources Conservation Service, Washington State Conservation Commission, Washington Department of Health, and staff from the Northwest Indian Fisheries Commission helped provide recommendations. Those recommendations lead to the development of the agriculture best management practices (BMP) funds part of the strategy.

The Core group decided that the 6-year strategy should focus on science as well as implementation of actions. When looking at implementation they would focus on managing nutrients and toxics by limiting the amount of pollutants that was released into the water, or they would cleanup already released pollutants. They decided to split the funding so that 50% would go to toxics and 50% to nutrients. Within each 50% allocation 10 % would go toward science and 40% would go towards implementation.

The 6-year strategy focused on implementing the following list of Near Term Actions:

Near Term Actions addressed in this 6 year strategy	
Toxics	
	C 1.1 Implement and strengthen authorities and programs to prevent toxic chemicals from entering Puget Sound
	C.1.2 Promote the development and use of safer alternatives to toxic chemicals
	C 1.4 - Provide education and technical assistance to prevent and reduce releases of pollution
	C 1.6 – Increase compliance with and enforcement of environmental laws, regulations and permits
	C 2.1 – Manage urban runoff at the basin and watershed scale.
	C 2.3 Fix problems caused by existing development
	C 2.4 – Control sources of pollution
Nutrients	
	C 1.4 - Provide education and technical assistance to prevent and reduce releases of pollution
	C 1.6 – Increase compliance with and enforcement of environmental laws, regulations and permits
	C 2.3 Fix problems caused by existing development
	C 3.2 – Ensure compliance with regulatory programs designed to reduce, control or eliminate pollution from working farms
	C 5.1 – Effectively manage and control pollution from on-site sewage systems
	C 7.3 – Ensure environmentally responsible shellfish aquaculture based on sound science
	C 7.5 – Answer key shellfish safety research questions and fill information gaps.
	C 9.1 – Complete Total Maximum Daily Load studies and other necessary water cleanup plans for Puget Sound to set pollution discharge limits and determine response strategies to address water quality impairment
	C 9.4 – Develop and implement local and tribal pollution identification and correction (PIC) programs

This agreement funded 56 projects.

Projects

Toxics - science

We were fortunate to have the 2011 Puget Sound Toxics Loading Assessment of toxics in Puget Sound to serve as the foundation for the toxics work in this NEP grant.

The overall goal of the Puget Sound Toxics Loading Assessment is to provide technical information to help develop toxic chemical control strategies for the Puget Sound basin. This

report is a synthesis of information generated on (1) chemical releases from human-caused sources, (2) the rates of chemical loading through various pathways, and (3) a basin-wide hazard evaluation for chemicals of concern.

The results of the hazard evaluation suggest that the following chemicals are most likely to be found at concentrations where effects are documented or at levels above criteria used to protect aquatic organisms and consumers of aquatic organisms:

- copper
- mercury
- polychlorinated biphenyls (PCBs)
- polychlorinated dioxins and furans (PCDD/Fs)
- the pesticide DDT (and its metabolites DDD and DDE)
- polycyclic aromatic hydrocarbons (PAHs)
- bis(2-ethylhexyl) phthalate (DEHP)

Based on this as a foundation, the science component to the toxics NEP grant-funded projects focused on:

- Better understanding of emerging chemicals.
- Understanding what toxics are found in fish.
- Source identification work and modeling work.

Challenges and lessons learned

Some of the challenging issues facing us as we look at toxics related to what we learned in the funded science projects are:

- Many fish are picking up toxics as they migrate though urban areas/streams.
- While restoration efforts might be focused on upstream areas there is a need to really focus on how to effectively address these toxics in urban areas.

Hopefully the Toxics in Fish implementation strategy will help us learn from these studies and focus efforts appropriately.

Also, the funding in these science sections confirmed that we are seeing more and more emerging chemicals of concern, for example pharmaceuticals, new chemicals we are still learning about, etc. How we get ahead of these chemicals or just keep them out of the waste stream will continue to be an important part of addressing toxics issues in Puget Sound. If anything, we want to avoid the ongoing problem we have with known toxics such as PCBs and mercury, which are prevalent throughout our environment and consistently found in fish tissue.

Successes – roof assessment

One project that we highlight as a success is our Roofing Assessment. This was a large project in the source identification bucket. The literature lead us to believe roofs were a key source of toxics to Puget Sound. We highlight this because there was good collaboration with the industry.

We learned that the literature values we used in the Toxics Loading study were higher than what we found when we conducted the actual study.

This study involved stakeholders throughout the process in designing a follow-up study to evaluate the contribution of various roofing materials as sources of pollutants. The end result was a more-informed study that both sides felt was meaningful. Both Ecology and stakeholders gained knowledge about the problem and worked together to find solutions. Stakeholders provided services and some funding for the study.

Overall the actual measured contaminant levels were lower than literature values:

- New asphalt shingles release low concentrations of metals.
- There is a high concentration of Cu in treated wood shakes and copper sheet roofing.
- Arsenic was also very high in the treated wood shakes.

Toxics –implementation

Our efforts on how to implement toxics reduction fell into four categories:

- Clean up the source of toxics pollution.
- Fund local efforts to control sources of pollution and prevent the toxics from getting into Puget Sound.
- Education and outreach work to explain how toxics get into the water and provide tools to individuals to empower them to keep toxics out of the waters.
- Look at toxic alternatives to see if there are less toxic chemicals that can be substituted for the more toxic chemicals.

One of the bigger investments we made was in cleaning up sources through local source control work. This work focused on small businesses. The goal is to work with and educate small businesses on how to eliminate dangerous waste, keep pollutants out of stormwater, manage stormwater, appropriately manage solid waste, and how to address spills when they occur. With this effort we funded six jurisdictions: Bothell, Snohomish County, Port Angeles, Kirkland and Everett.

Success - PAHs and wood stoves

The 2011 Puget Sound Source Assessment highlighted polycyclic aromatic hydrocarbons (PAHs) as a chemical on which to focus attention. PAHs are made up of about 100 different chemicals that are released from burning coal, oil, gasoline, trash, along with tobacco, wood and other organic substances including charcoal broiled meat. The 2011 Toxics assessment said that wood stoves and fireplaces are the largest sources of PAHs to Puget Sound. One of the sub-grant funded projects focused on replacing old woodstoves. Over 800 woodstoves were removed from use, resulting in about 600 pounds of PAHs removed from the environment.

Success - Creosote piling removal

There were a number of creosote piling removal projects that were funded by this grant. We followed up with some effectiveness monitoring projects and were able to make some substantial changes in procedures on how we conduct this work in the future.

One site in Quilcene Bay, located in herring and smelt spawning habitat, contained 482 pilings and was identified as a place to conduct effectiveness monitoring. The monitoring results raised a serious concern, as PAH concentrations in herring embryos at the site were 17 times higher on average after the pilings were removal than before.

Contractors performing the removal found the deteriorating pilings (approximately 100 years old) were difficult to remove. Many of the pilings were cut in place, and a large amount of loose creosote-coated debris was left behind after the removal operations ended. As a result of DFW's findings, along with a video survey of the area showing the sea floor at the site strewn with creosote-laden debris, DNR revised its piling removal protocols. This information was also useful to Ecology's Toxic Cleanup Program in producing a Standard Operating Procedure for piling removal operations at Puget Sound cleanup sites.

Nutrients

We did not have a nutrient assessment body of work like the Toxics Assessment, but we have worked to start comprehensive nutrient model for Puget Sound. The NEP investments from this grant helped finalize the Salish Sea model. We also used the NEP investments to start addressing nutrient obvious sources. A Nutrient Synthesis is being developed and a copy will be sent to EPA on completion.

Science

We made the following scientific investments on nutrient study and implementation:

- Finishing key work on the nutrient model to address all of Puget Sound. We added important components to it that would help inform where to focus nutrient reduction and ocean acidification efforts. By having this model complete we will meet the Biennial

Science plan goal of having a model that will help inform hat activities would have best result for addressing PS nutrient issues.

We also received some additional funding to use the ether model to better understand the ocean acidification issues facing Puget Sound. Nutrients are a key cause of ocean acidification.

- Salish Sea Model - NEP funding allowed us to add enhancements to the Salish Sea Model to evaluate ocean acidification, nutrient exchange between sediment-water (sediment diagenesis), and climate change impacts.

  We see nutrient effects in the form of low dissolved-oxygen listings. The model can be used to better understand the impacts of specific nutrient reduction projects—i.e., nutrient removal technologies on waste water treatment plants.

  Completion of this model to determine human causes of dissolved oxygen impairment was a critical piece in the overall strategy for how to address nutrient loads to Puget Sound. This model is being used as a foundation for development of the Puget Sound Nutrient Strategy. We held the kick-off meeting in July 2017 for this effort, and will hold more meetings throughout this year

  Here is what the current project schedule looks like:

  Phase 1: 2017 – end
  Share and communicate best available science so the public and stakeholders understand the problem.

  Phase 2: 2018 – 2021
  Collaboratively develop a Nutrient Reduction plan for Puget Sound.

  Phase 3: 2022 – 2032+
  Implement the nutrient reduction plan to improve water quality in Puget Sound.
- One of our projects is to develop a nutrient synthesis of all the nutrient projects done through this funding. Once it is complete we will provide a copy to EPA.

Implementation
The majority of nutrient implementation funding went to field staff to meet Near Term Actions that would increase compliance with environmental laws and reduce, control, or eliminate pollution from working farms.

Funding was also provided to support local efforts that addressed nutrient sources. These came out of TMDL strategies or other cleanup efforts.

We provided funds for getting WQ BMPS on the landscape. We did this on our own and also by coordinating with the Department of Health Pollution Identification and Correction (PIC) work.

We also funded efforts to install and monitor denitrifying septic systems, but in that process learned that the maintenance was too costly and difficult.

Conclusion

This federal grant provided flexible funding to allow Ecology to fund and pursue activities and sub-projects (NTAs) focused on enhancing Puget Sound. In addition, the results of this total body of work serves as a key foundational element for the continuation of the new EPA Strategic Initiative Funding Model and Ecology's efforts to improve Action Agenda Vital Signs through the Stormwater Strategic Initiative (SW SI) and the Marine Waters Initiative.

Final Lessons Learned

- This T/N grant allowed us to work with a period of time that allowed for the completion of the Salish sea model. Without that time frame we would not have been able to complete the model and have a good tool to inform the Marine Waters Initiative.

- Including both the Puget Sound Partnership and EPA Region 10 on the T/N Core Team helped to coordinate project development and funding decisions.

- By using the T/N management team format to develop and manage the 2015 Strategic Initiative Transition Team (SITT) for nine months helped provide continuity of concept for the NEP models. However, this significantly impacted the close attention to detail required to manage this large complex federal grant.

Individual projects funded under the first Nutrient and toxics NEP Grant - Rounds 1-4

Water Quality BMPS				
	Nutrients Implementation	$ 35,000	Whatcom Ag BMPs	
	Nutrients Implementation	$ 219,776	Ag BMPs in San Juan County	
	Nutrients Implementation	$ 37,749	Ag BMPs in Snohomish County	
	Nutrients Implementation	$ 56,821	Ag BMP Fund Technical Assistance and Quality Control (EP4 .2)	$ 349,346
Technical Assistance and Inspection				
	Nutrients Implementation	$ 90,660	Samish Inspector	
	Nutrients Implementation	$ 929,585	Whatcom Inspectors	
	Nutrients Implementation	$ 761,821	Northwest and SW Inspectors	$1,782,066
Local Nutrient Reduction Projects				
	Nutrients Implementation	$ 155,539	Kitsap Health Nutrient Reduction PIC: Murden Cove	
	Nutrients Implementation	$ 427,287	City of Bellingham Phosphorus Management for Lake Whatcom	
	Nutrients Implementation	$ 218,531	City of Olympia South Sound Natural Lawn Care	
	Nutrients Implementation	$ 65,276	Pacific Shellfish institute Budd Bay Nutrient Implementation	
	Nutrients Implementation	$ 251,247	Capital Land Trust Johns Creek Estuary Conservation	
	Nutrients Implementation	$ 359,640	HC Salmon Enhancement Group Hood Canal Onsite Septic System (OSS)	
	Nutrients Implementation	$ 27,062	UW Stormwater Center Stormwater LID	
	Nutrients Implementation	$ 86,777	Univ. of WA Sound Toxins Partnership Harmful Algal Blooms Monitoring	$1,591,359
Denitrifying Septic System				
	Nutrients Implementation	$ 312,863	WA DOH OSS Denitrification Verification	
	Nutrients Implementation	$ 312,262	Univ of WA OSS Denitrification Verification	$ 625,125
	Nutrients Implementation Total	$4,347,896		$4,347,896
Alternatives				
	Toxics Implementation	$ 497,631	Techlaw Inc Establishing a Green Chemistry Center	
	Toxics Implementation	$ 27,000	Clean Production Action Dev of Chemical Haz-Based Tech Altern Assess Guidance	
	Toxics Implementation	$ 69,450	Pure Strategies, Inc. Technical Writer for Alternative Assessment Guidance	
	Toxics Implementation	$ 165,574	Alternatives Assessment Guide	
	Toxics Implementation	$ 145,150	Cooper Bottom Boat Paint AA and Outreach	
	Toxics Implementation	$ 70,247	Sectors Go Green	$ 975,052
Education and Outreach				

	Toxics Implementation	$ 159,735	SPU Drips and Leaks Toxics Education / Outreach	
	Toxics Implementation	$ 50,000	Drips and Leaks Toxics Education / Outreach	
	Toxics Implementation	$ 20,000	Landscape Accreditation ECY management	
	Toxics Implementation	$ 280,000	Landscape Accreditation	
	Toxics Implementation	$ 100,000	NWIFC Development of Fish Consumption Rate	
	Toxics Implementation	$ 58,238	Fish Consumption Rates	
	Toxics Implementation	$ 73,985	WSDA Pesticide Use Survey	$ 741,958
Clean Up Sources				
	Toxics Implementation	$ 550,000	SPU Stormwater Cleaning	
	Toxics Implementation	$ 213,976	PBDE Enforcement	
	Toxics Implementation	$ 731,970	DNR Quilcene Creosote Piling Removals	
	Toxics Implementation	$ 250,000	PS Clean Air Implementing CAPs Cleaner burning wood burning stoves	
	Toxics Implementation	$ 135,317	Pierce County Chambers Creek Piling Removal	
	Toxics Implementation	$ 345,387	PS Clean Air Implementing CAPs Cleaner burning wood burning stoves	
	Toxics Implementation	$ 205,000	PAHs and Railroads	$2,431,650
Local Source Control				
	Toxics Implementation	$ 1,926,377	Multiple Jurisdictions Local Source Control Partnership (rds. 1-4)	$1,926,377
	Toxics Implement Total	$6,075,037		
Ocean Acidification				
	Nutrients Science	$ 352,310	Ocean Acidification Modeling	
	Nutrients Science	$ 20,000	UW Ocean Acidification	$ 372,310
Nutrient Model				
	Nutrients Science	$ 377,510	Model sediment-water interactions in Puget Sound	
	Nutrients Science	$ 301,500	USGS Nutrient Science	
	Nutrients Science	$ 40,000	pH Model Phase I	
	Nutrients Science	$ 130,256	Nitrogen Synopsis	$ 849,266
Marine Water Monitoring				
	Nutrients Science	$ 315,366	Ferry-Based Monitoring	
	Nutrients Science	$ 194,025	UW High Resolution Marine Water Quality Monitoring	$ 509,391
Effectiveness Monitoring				
	Nutrients Science	$ 150,000	Agriculture Effectiveness Monitoring	$ 150,000
	Nutrients Science Total	$ 1,880,967		
Emerging Chemicals				
	Toxics Science	$ 237,667	WDFW/NOAA Chemicals of Emerging Concern	
	Toxics Science	$ 499,998	UW Emerging Contaminants	$ 737,665
Toxics Monitoring in Fish				
	Toxics Science	$ 49,612	WDFW Juvenile Chinook Salmon Contaminant Monitoring	
	Toxics Science	$ 80,026	NOAA Juvenile Chinook Salmon Contaminant Monitoring	

	Toxics Science	$ 185,538	WDFW Seafood project	$ 315,176
Source identification				
	Toxics Science	$ 561,811	Roofing Project	
	Toxics Science	$ 173,000	Marina Metals Study	
	Toxics Science	$ 102,000	Elliot Bay Sediment Monitoring	$ 836,811
Modeling				
	Toxics Science	$ 177,475	Box Storm Model	$ 177,475
	Toxics Science Total	$ 2,067,127		

References

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